

Type of structure

Type of surface conditions for cases involving conduit

Type of building entrance (aerial or conduit)

8. A site-specific cost estimate was obtained from a qualified local contractor for 50% of the sample locations.
9. The contractor and PEI personnel then reviewed the site specific estimates and related them to the type of structure (aerial or buried), permitting jurisdictions, and path length sections by surface condition (asphalt, concrete, sod, etc.). Unit cost factors were developed for the various jurisdictions and path conditions. Cost estimates for the remaining samples were then made by applying the unit cost factors to the path data acquired for the remaining locations.
10. Statistical indicators (average, standard deviation, median, and total variation) were determined for path costs within each band and the initial estimates of sample size by band were validated and revised, as indicated.
11. The average cost for each band, reduced 40% for common structure usage (a path segment used to connect more than one adjacent locations to the backbone route, see second paragraph under "Assumptions" above), was used as the path structure cost for all locations within the band which were not sampled.
12. Costs for utility holes which would need to be added to the backbone routes for access were calculated as follows:
 - Cost per hole was estimated at \$8,000
 - Percent of locations by band needing a hole was determined from samples.
 - Utility hole costs per path were then multiplied by 25% to reflect that, on average, four paths share each hole (See ASSUMPTIONS, Utility hole costs, above).

The resulting calculation of an average utility hole cost per location, by band, was:

$(\text{Cost per hole}) * (\% \text{ of locations in band needing a hole}) * (25\% \text{ sharing factor})$

Example, for the 0 to 1,000 foot band:

$\$8,000 * 33.9\% * 25\% = \678 , average utility hole costs per location in the band.

Cable Costs:

1. An Average cable length for each band was developed from the sample locations. The total distance from the access point on the nearest CAP route to the estimated location of the equipment room at the customer location was computed for each sample location within each band.

2. These average lengths for each band were then multiplied by the unit cost of fiber cable, loaded to account for placing, splicing and other costs.
3. This average cable cost by distance band is the estimating factor for cable costs for all customer locations within each particular band.

The sample locations, grouped by distance band, and the specific path cost estimates for each, are displayed in Chapter VIII, the Appendix, Section B. PATH COSTS. This Section also provides the average path cost for each band. These average path costs by band are applied to all locations, in the attached Cost Model, displayed in the Appendix, Section D.. TOTAL COSTS.

IV

ESTIMATING METHODS AND ASSUMPTIONS EQUIPMENT COSTS

TASK:

Develop an economical method of estimating costs for capital budgeting purposes, for the equipment required to provide the indicated service, using fiber-optic cable as the transmission medium.

DESCRIPTION:

This includes the equipment at the customer location required to provide the service, plus the incremental equipment at the CAP hub necessary to interface with the equipment at the customer location.

For each of the service types under consideration, equipment costs for the first circuit typically include "common equipment" which enable a number of similar circuits to be provided quickly, and at little additional cost. For DS-1 service, for example, the cost to provide 24 DS1 circuits over fiber cable is very little more than the cost to provide a single DS1 circuit, because the same amount of common equipment must be installed in either case.

Equations to describe these costs take the approximate form of the equation for a straight line, $y = mx + b$, for a range of circuit volume (groups of twenty-four in the case of DS1 circuits). In the DS1 example,

y = the equipment costs at the location

b = is the cost of the common equipment necessary to support a group of
up to 24 DS1 circuits

m = the incremental cost per DS1, and

x = the number of DS1 circuits provided

The factors " m " and " b " change for various ranges of volume of DS1 circuits (similar for other bandwidths), requiring that different formulas be chosen based upon the circuit volume. This is because as circuit volume increases, it becomes economic to utilize higher capacity equipment, with different unit cost characteristics.

Although single DS1 circuits, for example, can be provided without placing the common equipment required to support twenty-four DS1's, this is rarely done because the "break even" point is very low. When growth occurs, per circuit costs on the "one-at-a-time" basis far exceed the costs of planning for groups of twenty-four.

Equipment is also required at the CAP hub to interface with each circuit installed at the customer premises.

PEI developed the formulas to fit each circuit type and volume by obtaining equipment costs from manufacturers and by estimating loadings for installation with the aid of a consultant with expertise in the field.

ASSUMPTIONS:

1. A Central Office or equivalent is in place and contains the higher order DS1 to OC-n equipment for distribution to a customer. The higher order transmission equipment is assumed to be in a "protected ring" configuration
2. The service is delivered to the customers premise via fiber cable. Four fibers will be assigned per system when service levels exceed three DS1's, two primary and two alternate route fibers. Automatic alternative route switching equipment is included, again, when service levels exceed 3 DS1's at a given location. All equipment will be protected against system card failure.
3. The loaded cost in the "hub" or C.O. is defined as the incremental equipment added to an existing system to facilitate the service. EG: Tx/Rx fiber cards, fiber jumpers, jack and frame interconnect, etc.
4. From one to twelve DS1 circuits are delivered via a fibered, Quad DS1 system, which delivers four circuits per Quad DS1 system.
5. When thirteen to 56 DS1's are required, a fibered DS3 multiplexer will be placed. The pricing shall include hub transceivers and customer premises common equipment plus incremental DS1 cards at the customer location up to a maximum of 28 DS1's per DS3 system.
6. When more than 56 DS1's are required, a fibered OC-3 system shall be placed. Pricing shall include hub transceivers and customer premises common equipment, plus incremental DS1 cards at the customer location up to a maximum of 84 DS1's per OC-3 system.
7. When a mix of DS1 and DS3 services are required, an OC3 or higher rate system will be placed. The pricing shall be incremental for each DS1 and DS3.
8. DS3 only: from one to three DS3's - an OC3 system will be placed. Pricing shall include hub transceiver plus customer premises common equipment, plus one DS3 card per circuit, to a maximum of three per system.
9. DS3 only: from four to twelve DS3's - an OC-12 system will be placed. Pricing shall include hub transceiver plus customer premises common equipment, plus one DS3 card per four DS3 circuits, up to a total of twelve DS3's per OC-12 system.
10. DS3 only: more than twelve DS3's - an OC-48 system will be placed. Pricing shall include hub transceiver plus customer premises common equipment, plus one DS3 card per four DS3 circuits, up to a total of 48 DS3's per OC-48 system.
11. When an OC3 or higher bandwidth service is required, a one-to-one configuration will be added. EG: an OC3 driver at the hub and an OC3 Tx/Rx at the customer premise.
12. When a higher order service is required (OC-3, OC-12, etc.), the hub location will always contain a system with enough bandwidth to accommodate the customer via

system cards. EG: an OC-3 requirement will be fed with an OC-12 system, an OC-12 requirement with an OC48 system.

13. The distance from hub to customer is short, less than 10,000 ft. All distribution cable is in place, terminated at distribution panels, and tested for performance at the hub and customer locations.
14. No Wave Division Multiplexer or any other "fiber bandwidth gaining" device shall be used to serve the customer. All fiber drivers shall be LED (Light Emitting Diode), low power, 1310 nm.
15. All pricing is loaded and consists of the following:
 - a. Equipment - customer location - shelf, common cards with protection, cabling, customer electrical interface, fiber jumpers, power and LED drivers. If service requirements exceed three DS1's, high speed interface cards and high speed switching cards are included for automatic route protection switching.
 - b. Equipment - hub location - system cards, fiber jumpers.
 - c. Engineering - both locations. Includes drawings, site survey, records, and assignments.
 - d. Installation - both locations. Includes unpacking, inventory, inspection, mounting, cabling (copper and fiber), cable continuity, system power up, updating records and cleanup of area.
 - e. Test and turn-up - both locations. Includes all system operations, alarms, end to end performance and interconnect to demarcation.
 - f. Maintenance - a factor is added to cover call outs and routine updates.
 - g. Performance Monitoring - a factor is added to support the addition of the service to the Network Operations Center.
 - h. Taxes and transportation are included in the loaded cost.
16. All customer premise equipment is AC powered. Uninterrupted Power Source (UPS) is not included.
17. No particular vendor is specified in this study. All pricing was derived from list prices with an average 15% (fifteen percent) discount, multiplied by a loading factor for installation. This method offers a median installed cost which may vary by 5%, depending on local factors. To narrow the margin, several vendors have been researched.
18. All customer premise equipment will be placed in an environmentally controlled location.
19. All customer premise equipment will be slave timed by the hub, referenced to a stratum one timing source.

ESTIMATING PROCEEDURE - EQUIPMENT:

Methods for serving each type, volume and mix of services were examined.

1. Equipment prices, loaded for installation, etc., were developed, referencing a number of vendors.
2. Equipment configurations for each type, combination, and volume of service types were determined.
3. Pricing algorithms were developed for each type, combination and volume of service types.
4. Logic statements were written in a commercially available software, to allow the software to select the proper algorithm for the service required, at each customer location.
5. The algorithms were applied to the data for each location to determine the specific cost for each location.
6. These equipment costs were then added to path costs to estimate the total cost for each customer location.

The resulting equipment cost formulas were applied to all locations, along with logic functions to select the appropriate formula for each combination of service types and volumes. These formulas are described in detail in Chapter VIII, the Appendix, Section C. EQUIPMENT COSTS.

COST MODEL

The cost model is a programmed spreadsheet in a commercially available software (Microsoft Excel®). The procedure used is as follows:

1. All Phoenix Metro hi-cap customer locations in U S WEST's data base were distributed into distance bands from the nearest CAP fiber-optic cable route, as described in Section III above, and entered into the spreadsheet.
2. Path costs were estimated by applying the average path cost for each band, determined as described in Section III, to all locations in the band.
3. Equipment cost algorithms were entered for each type, mix, and volume of services.
4. Logic statements were programmed to drive the software to select the proper equipment cost algorithm to serve each customer location, based on the service requirements at the location. This yielded unique equipment costs by location.
5. Path and equipment costs were summed for each location and then by band.

The resulting costs are summarized in the Executive Summary above.

Costs for all locations are provided and summarized by band in the Appendix, Section D. TOTAL COSTS - FOR ALL LOCATIONS, BY BAND.

6

BUILD TIME AND BUILD STRATEGIES

DEFINITION: The time required to build facilities and turn up service to a customer location is defined for this purpose as beginning at the time engineering is commenced, until service is turned up. This includes the time required to do the engineering, acquire digging permits and other rights-of-way, build the structure, install and terminate the cable, test the cable; and install, test and turn-up the equipment, and perform any hub or distant end functions which may be required. It is assumed that a suitable, environmentally controlled equipment space is available at the customer location.

The timetables outlined below are in the context of normal conditions. This means normal approval processes and time intervals for permits to use the public rights-of-way and other right-of-way acquisition, for traffic control measures, etc. It also contemplates normal concerns for the economics of construction - a balance between construction speed (the number of crews which can be efficiently managed simultaneously) and construction costs (use of only the best crews, at a rate that can be managed for maximum efficiency). If there were a crisis or emergency condition in which the continuity of data communications were in jeopardy, the time to build could be shortened considerably from the intervals outlined below.

TIME REQUIRED TO BUILD TO A SPECIFIC LOCATION - VARIATIONS:

The time required to build to different sites may vary significantly. Differences in build times are driven primarily by variations in the paths, such as length, digging conditions, etc. However, given a large number of sites to build to, an average time of two weeks per site can be managed economically in the Phoenix area. This is based on the experience of a qualified Phoenix contractor.

Applying more labor and equipment can shorten this time, but unit costs rise because of inefficiencies related to crowded work site conditions and the number of construction crews (simultaneous different construction locations) which can be effectively managed. Many factors that influence build time are beyond the control of the building party. These include governmental intervals for issuance of digging permits, Blue Stakes intervals (location of existing utilities), time required by owners of existing utilities to rearrange or safeguard them, limitations imposed by governments on construction activity in order to maintain public safety and convenience, etc.

The customer locations in the U S WEST database are widespread, but large concentrations of them are located along major business corridors. Given traffic flow and other public safety and convenience factors, it is estimated that a major construction effort could result in reaching those 1,508 locations within 1,000 feet of an existing CAP fiber route, in 18 to 24 months. It is estimated that a total of 24 to 36 months would be required to reach all 3,101 locations included in the study.

It is expected that the first six weeks to two months of a major building program would be absorbed in the initial acquisition of rights-of-way, digging permits, locating activity and traffic control planning. Beyond this period, these activities for the next sets of locations can be pursued in parallel, during the same time that physical construction to the initial sites is underway.

BUILD STRATEGIES:

Equipment costs are proportional to the volume of services at a location, and therefore are also proportional to revenue potential. Path costs, on the other hand, are a function of distance and surface conditions, almost independent of the volume of services (and thus potential revenue). Net operating income could therefore be optimized by focusing on the largest service volume customer locations with the lowest path costs, generally those nearest to the existing CAP fiber routes. In fact, it is reasonable to assume that the layout of the existing CAP routes was developed to minimize the total distance to the maximum number large service volume customer locations.

A likely CAP build strategy would appear to involve several elements, all aimed at maximizing the number of services provided (revenue) while minimizing the total path distance (cost). Such a strategy could be focused on the following locations:

- Locations with high service volumes near the existing CAP routes. (Note that 50% of U S West customer locations are within 1,000 feet of these routes, and if the distance is extended to 2,000 feet, 69% of locations are covered.).

- Extend further from existing routes, prioritizing targets based on service volumes, distances and adjacent addresses (opportunity to share path costs with more than one location).

- Extend long distances only when service volumes are high and path costs are low (aerial paths for fiber cable, or DSL service provided via wireless).

VII

ACCESS VIA WIRELESS FACILITIES

Several transmission facility options are open to a CAP seeking to provide service to a customer. These include leasing a circuit from U S West, connecting the customer to the CAP fiber-optic ring via a fiber-optic cable, and connecting the customer to the CAP network (either to a point on or near a fiber ring, or directly to a CAP hub) via microwave radio. The wireless alternative requires a clear line-of-sight between antennas and/or reflectors on the route.

One and two DS1 capacity radio systems are economical (roughly \$20,000 per DS1 for spread-spectrum radio equipment, antennas and installation), and do not require the time-consuming licensing process. Transmission is relatively free from troubles induced by atmospheric disturbances at distances up to 6 miles, making them very attractive for rural and near-rural environments. However, obtaining zoning approval for the 2' to 3' dish antennas and the costs of antenna site leases can be a serious time and cost obstacle. These issues relegate the use of spread spectrum systems to locations at which circuits are not available for lease, or where new construction is required to furnish the service, and construction intervals are long and special charges apply.

Small numbers of DS1 circuits can also be provided by specialized common carriers, which lease 38GHz systems. Installation is typically prompt with a monthly lease cost near \$300 per DS1. Antennas may be as small as an 18" dish mounted inoffensively behind a camouflage screen on the side or roof of a building. However, as in the case of spread spectrum systems, this alternative is usually employed only for locations for which existing circuits are not readily available. The cost of leasing a single DS1 circuit from U S West is about \$350/month, and no zoning approvals, antenna site leases (sometimes required at both ends of the link), nor transmission power costs apply. Furthermore, the 38GHz systems are susceptible to rain fade during heavy thunderstorms. Route lengths are usually limited to about 3 miles (depending on terrain) to minimize atmospherically induced fade.

Digital radio systems are available for service at the OC-3 and greater levels, but their cost characteristics and large antennas (serious zoning issues) suit them more for long-haul transmission than for local use. These systems require FCC licensing on a per-link basis, which may involve significant lead-time.

The state-of-the-art in wireless systems is advancing rapidly. In addition to digital point-to-point radio, multipoint broadband radio systems now being developed (LMDS) promise economical alternative means of hi-cap transmission in the future.

To summarize, while leased circuits for small quantities of DS1's are often the economic choice in urban areas, and fiber cable is favored for its tremendous bandwidth capability; practical wireless alternatives are available, and are becoming increasingly competitive.

VIII

APPENDIX DATA AND DATA SOURCES

- I. Development of sampling process and sample sizes:
STATISTICAL METHODS, Snedecor and Cochran, Sixth Edition, The Iowa State University Press, pp. 516-517.
- II. Structure Costs, including Building Entry and extension to Equipment Room:
Location Specific Cost Estimates by Frank Chilcoat of ECSI, Communicor, Inc., Phoenix, Arizona, Phoenix Area Construction Contractor
- III. Cable Sizes and Types
PEI Experience
Frank Chilcoat of ECSI, Communicor, Inc., Inc., Phoenix, AZ
- IV. Cable Costs
PEI Experience
Graybar Electric Co., Inc.
Frank Chilcoat of ECSI, Communicor, Inc., Inc., Phoenix, AZ
Lawrence Young, Former Design Engineer, GST Inc., Phoenix, AZ
- V. Installation and Termination Loadings on Cable Costs
PEI Experience
Frank Chilcoat of ECSI, Communicor, Inc., Inc., Phoenix, AZ
Lawrence Young, Former Design Engineer, GST Inc., Phoenix, AZ
- VI. Equipment Configurations and Costs
Donald M. Malagisi, R & L Electronics, Lakewood, CO., equipment broker and network design consultant.
- VII. Build Time
PEI Experience
Frank Chilcoat, ECSI, Communicor, Inc.
- VIII. Wireless Access Reference
PEI Experience
IEEE Proceedings, December, 1997, Volume 12, and pp. 1958-1972, M. Gagnaire: An Overview of Broad-Band Access Technology

VIII

APPENDIX
DATA AND DATA SOURCES

CONTENTS, DATA AND SOURCES

- A. SOURCES OF DATA AND SAMPLINGS METHODS
- B. PATH COSTS - LOCATION SPECIFIC ESTIMATES FOR SAMPLES IN EACH BAND
EXCEL ® SPREADSHEET "PATHCOST.XLS"
- C. EQUIPMENT COSTS - FORMULAS FOR VARIOUS SERVICE SCENARIOS
EXCEL ® SPREADSHEET "EQPT COST.XLS"
- D. TOTAL COSTS - FOR ALL LOCATIONS, BY BAND
EXCEL ® SPREADSHEET "TOTAL COST.XLS"

APPENDIX
DATA AND DATA SOURCES

- B. PATH COSTS - LOCATION SPECIFIC ESTIMATES FOR SAMPLES IN EACH BAND
EXCEL ® SPREADSHEET "PATHCOST.XLS"

Phoenix Fiber Study
Cost Model - Competitive Access Providers
Developed by POWER Engineers, Inc. for US WEST Communications
Sample Locations

DISTANCE BAND 1: 0 TO 1,000 FT FROM NEAREST CAP FIBER ROUTE									
KEY	CITY	DS1	DS3	OC-3	OC-12	OC-48	PATH COST	EQPT COST	TOTAL COST
1 PHX		222	5	0	0	0	11,000	233,300	244,300
2 PHX		1	0	0	0	0	11,000	5,468	16,468
3 SCTSDL		2	0	0	0	0	11,000	5,468	16,468
4 TEMPE		1	0	0	0	0	11,000	5,468	16,468
5 PHX		1	0	0	0	0	11,000	5,468	16,468
6 PHX		2	0	0	0	0	11,000	5,468	16,468
7 PHX		1	0	0	0	0	11,000	5,468	16,468
8 PHX		4	0	0	0	0	11,000	8,068	19,068
9 PHX		2	0	0	0	0	11,000	5,468	16,468
10 PHX		1	0	0	0	0	11,000	5,468	16,468
11 PHX		1	0	0	0	0	11,000	5,468	16,468
12 PHX		1	0	0	0	0	11,000	5,468	16,468
13 PHX		4	0	0	0	0	11,000	8,068	19,068
14 CHNDLR		2	0	0	0	0	11,000	5,468	16,468
16 CHNDLR		3	0	0	0	0	11,000	5,468	16,468
17 TEMPE		1	0	0	0	0	11,000	5,468	16,468
18 PHX		14	0	0	0	0	11,000	23,192	34,192
19 PHX		10	0	0	0	0	11,000	24,204	35,204
20 MESA		33	0	0	0	0	11,000	47,089	58,089
21 PHX		1	0	0	0	0	11,000	5,468	16,468
22 TEMPE		1	0	0	0	0	11,000	5,468	16,468
24 TEMPE		1	0	0	0	0	11,000	5,468	16,468
25 PHX		290	8	0	0	0	11,000	287,666	298,666
26 PARA VLY		1	0	0	0	0	11,000	5,468	16,468
27 PHX		3	0	0	0	0	11,000	5,468	16,468
29 SCTSDL		1	0	0	0	0	11,000	5,468	16,468
30 PHX		3	0	0	0	0	11,000	5,468	16,468
31 TEMPE		2	0	0	0	0	11,000	5,468	16,468
33 PHX		3	0	0	0	0	11,000	5,468	16,468
35 PHX		2	0	0	0	0	11,000	5,468	16,468
37 PHX		1	0	0	0	0	11,000	5,468	16,468
39 TEMPE		11	0	0	0	0	11,000	24,204	35,204
40 PHX		3	0	0	0	0	11,000	5,468	16,468
41 PHX		1	0	0	0	0	11,000	5,468	16,468
42 CHNDLR		5	0	0	0	0	11,000	16,136	27,136
43 SCTSDL		1	0	0	0	0	11,000	5,468	16,468
46 PHX		1	0	0	0	0	11,000	5,468	16,468
48 PHX		7	0	0	0	0	11,000	16,136	27,136
49 PHX		11	0	0	0	0	11,000	24,204	35,204
50 PHX		28	1	0	0	0	11,000	49,686	60,686
51 PHX		3	0	0	0	0	11,000	5,468	16,468

Phoenix Fiber Study
Cost Model - Competitive Access Providers
Developed by POWER Engineers, Inc. for US WEST Communications
Sample Locations

DISTANCE BAND 1: 0 TO 1,000 FT FROM NEAREST CAP FIBER ROUTE								
52 PHX	3	0	0	0	0	11,000	5,468	16,468
57 SCTSDL	2	0	0	0	0	11,000	5,468	16,468
60 MESA	1	0	0	0	0	11,000	5,468	16,468
63 MESA	1	0	0	0	0	11,000	5,468	16,468
65 TEMPE	2	0	0	0	0	11,000	5,468	16,468
66 PHX	1	0	0	0	0	11,000	5,468	16,468
68 MESA	1	0	0	0	0	11,000	5,468	16,468
70 PHX	1	0	0	0	0	11,000	5,468	16,468
71 SCTSDL	1	0	0	0	0	11,000	5,468	16,468
72 TEMPE	4	0	0	0	0	11,000	8,068	19,068
75 PHX	1	0	0	0	0	11,000	5,468	16,468
76 PHX	2	0	0	0	0	11,000	5,468	16,468
89 P	3	0	0	0	0	11,000	5,468	16,468
93 PHX	1	0	0	0	0	11,000	5,468	16,468
94 MESA	2	0	0	0	0	11,000	5,468	16,468
100 PHX	3	0	0	0	0	11,000	5,468	16,468
104 PHX	8	9	0	0	0	11,000	89,748	100,748
105 PHX	3	4	0	0	0	11,000	60,150	71,150
Sub-Totals						\$649,000	\$1,160,511	
Sum of Total Cost								\$1,809,511
Average of Total Cost								\$30,670

PATH COST

0 TO 1,000 FT FROM CLEC FIBER ROUTE, ID'S 1-52															
ID	CITY	DS-1	DS-3	DIST, FIBER TO PROP	DIST, PROP TO BLDG ENTR.	DIST, BLDG ENT TO EQP ROOM	PATH TYPE	STRUC. COST	STR \$ PER FT	FEET, TDIST	ID	MH	PATH COST	CABLE COST	TOT OSP COST
1	PHX	222	5	200	200	150	ACB	8,000	14.55	550	1	0	8,000	880	8,880
2	PHX	1	0	50	500	150	C	19,000	27.14	700	2	0	19,000	1120	20,120
3	SCTSDL	2	0	300	800	100	BUR	31,000	25.66	1200	3	8,000	39,000	1920	40,920
4	TEMPE	1	0	700	60	90	BUR	22,000	25.66	850	4	8,000	30,000	1360	31,360
5	PHX	1	0	150	15	125	C/B	7,500	25.86	290	5	8,000	15,500	464	15,964
6	PHX	2	0	400	50	150	C	13,800	23.00	600	6	8,000	21,800	960	22,760
7	PHX	1	0	100	100	100	ACD	9,500	31.67	300	7		9,500	480	9,980
8	PHX	4	0	100	500	150	A/C	21,000	28.00	750	8		21,000	1200	22,200
9	PHX	2	0	300	150	80	A/C	12,000	22.64	530	9	8,000	20,000	848	20,848
10	PHX	1	0	500	200	150	C/B	19,500	22.94	850	10		19,500	1360	20,860
11	PHX	1	0	100	100	200	A/C	14,500	36.25	400	11		14,500	640	15,140
12	PHX	1	0	150	50	100	A/C	10,500	35.00	300	12		10,500	480	10,980
13	PHX	4	0	50	10	50	A	8,000	72.73	110	13		8,000	176	8,176
14	CHNDLR	2	0	100	50	150	BUR	10,000	34.11	300	14	8,000	18,000	480	18,480
16	CHNDLR	3	0	600	80	125	BUR	20,500	25.66	805	16	8,000	28,500	1288	29,788
17	TEMPE	1	0	320	0	75	AER	5,500	14.39	395	17		5,500	632	6,132
18	PHX	14	0	150	1350	175	A/C/B	34,500	20.50	1675	18		34,500	2680	37,180
19	PHX	10	0	200	200	200	ACB	25,000	41.67	600	19		25,000	960	25,960
20	MESA	33	0	200	0	150	AER	5,000	14.39	350	20		5,000	560	5,560
21	PHX	1	0	360	50	100	BUR	13,500	26.89	510	21		13,500	816	14,316
22	TEMPE	1	0	600	625	75	BUR	26,500	20.50	1300	22	8,000	34,500	2080	36,580
24	TEMPE	1	0	220	120	25	BUR	12,500	34.11	365	24	8,000	20,500	584	21,084
25	PHX	290	8	600	600	100	A/C/B	29,000	22.31	1300	25		29,000	2080	31,080
26	PARA VLY	1	0	400	600	150	C/G	24,000	20.87	1150	26		24,000	1840	25,840
27	PHX	3	0	200	125	85	A/C/B	8,500	20.73	410	27		8,500	656	9,156
29	SCTSDL	1	0	300	75	100	A/C/G	15,000	31.58	475	29		15,000	760	15,760
30	PHX	3	0	300	300	120	A/C/B	16,500	22.92	720	30		16,500	1152	17,652
31	TEMPE	2	0	350	20	70	BUR	12,000	26.89	440	31	8,000	20,000	704	20,704

PATI OST

33 PHX	3	0	75	50	125 AC	8,000		250	33		8,000	400	8,400
35 PHX	2	0	125	50	100 ACB	9,500	34.55	275	35		9,500	440	9,940
0 TO 1,000 FT FROM CLEC FIBER ROUTE, ID'S 1-52													
			DIST, FIBER TO	DIST, PROP TO BLDG	DIST, BLDG TO EQP ROOM	STRUC. COST	STR \$ PER FT	FEET, TDIST			PATH MH	CABLE COST	TOT OSP COST
ID	CITY	DS-1	DS-3	PROP	ENTR.				ID				
37 PHX		1	0	800	300	100 ACB	28,500	23.75	1200	37	8,000	36,500	38,420
39 TEMPE		11	0	40	40	80 BUR	11,500	72.00	160	39		11,500	11,756
40 PHX		3	0	350	225	125 A	16,000	22.86	700	40		16,000	17,120
41 PHX		1	0	400	0	200 BUR	16,000	26.89	600	41	8,000	24,000	24,960
42 CHNDLR		5	0	800	250	100 AER	16,500	14.39	1150	42	8,000	24,500	26,340
43 SCTSDL		1	0	200	130	70 AER	6,000	14.39	400	43		6,000	6,640
46 PHX		1	0	300	300	20 C	14,500	23.39	620	46		14,500	15,492
48 PHX		7	0	150	50	125 ACB	9,500	29.23	325	48		9,500	10,020
49 PHX		11	0	75	150	75 D	8,000	26.67	300	49		8,000	8,480
50 PHX		28	1	700	200	190 A/C	17,500	16.06	1090	50	8,000	25,500	27,244
51 PHX		3	0	300	75	125 AER	5,500	11.00	500	51		5,500	6,300
52 PHX		3	0	50	250	200 A/C	23,000	46.00	500	52		23,000	23,800
57 SCTSDL		2	0	700	0	100 AER	11,500	14.39	800	57		11,500	12,780
60 MESA		1	0	5	60	150 AER	3,000	14.39	215	60		3,000	3,344
63 MESA		1	0	200	0	200 AER	6,000	14.39	400	63		6,000	6,640
65 TEMPE		2	0	200	70	200 AER	7,000	14.39	470	65	8,000	15,000	15,752
66 PHX		1	0	900	300	200 A/G	32,000	22.86	1400	66	8,000	40,000	42,240
68 MESA		1	0	125	45	85 A/C	7,500	29.41	255	68	8,000	15,500	15,908
70 PHX		1	0	900	400	75 A/C	32,000	23.27	1375	70		32,000	34,200
71 SCTSDL		1	0	350	500	350 AC	31,000	25.66	1200	71	8,000	39,000	40,920
72 TEMPE		4	0	100	700	200 AER	14,500	14.39	1000	72		14,500	16,100
75 PHX		1	0	300	150	50 A/B	7,500	15.00	500	75	8,000	15,500	16,300
76 PHX		2	0	400	200	80 A/C/G	11,000	16.18	680	76	8,000	19,000	20,088
89 P		3	0	350	125	50 AER	8,500	16.19	525	89		8,500	9,340
93 PHX		1	0	1000	120	40 AER	16,500	14.39	1160	93		16,500	18,356

PATH COST

94 MESA	2	0	30	240	250 AER	7,500	14.39	520	94	7,500	832	8,332
100 PHX	3	0	500	129	250 AER	18,000	20.48	879	100	18,000	1406	19,406
104 PHX	8	9	250	150	200 BORE	35,000	58.33	600	104	35,000	960	35,960
105 PHX	3	4	800	500	200 A/C/G	33,000	58.33	600	105	33,000	0	33,000
# SAMPLES =	59				STRUCT TOT =	925,800		MH TOT =	160,000	1,085,800	61,238	1,147,038
					STRUCT AVG=	15,692		AVG=	2,712	18,403	1,038	19,441
ADJUST FOR COMMON STRUCTURE AND COMMON MANHOLE USE				=	STRUCTURE COST=			MH COST=			MEDIAN	17,652
					AVG * 60%	\$9,415		AVG * 25%	\$678		STD DEV	10,307
					TOTAL PATH COST AVG =		\$11,131				AVG	19,441
											SD % OF MEAN	53%

PAT OST

1,000 TO 2,000 FT FROM CLEC FIBER ROUTE																			
ID	CITY	DS-1	DS-3	DIST, FIBER TO PROP	DIST, PROP TO BLDG ENTR.	DIST, BLDG ENT TO EQP ROOM	PATH TYPE	STRUC. COST	STR \$ PER FT	FEET, TDIST	ID	MH	PATH COST	CABLE COST	TOT OSP COST				
23	PHX	1	0	1200	700	250	AC	35,000	16.28	2150	23		35,000	3440	38,440				
28	PHX	6	0	1850	250	150	A/C/B	31,000	13.78	2250	28	8,000	39,000	3600	42,600				
32	PHX	5	0	1600	120	180	BUR	33,500	17.68	1900	32	8,000	41,500	3040	44,540				
34	PHX	1	0	1800	150	75	AERIAL	23,000	11.36	2025	34		23,000	3240	26,240				
36	PHX	2	0	1900	250	80	AERIAL	39,000	17.49	2230	36		39,000	3568	42,568				
38	TEMPE	3	0	1500	100	65	BUR	29,500	17.68	1665	38	8,000	37,500	2664	40,164				
45	PHX	2	0	1800	200	75	AC	42,000	20.24	2075	45		42,000	3320	45,320				
47	PHX	1	0	1400	50	50	AER	19,500	13.00	1500	47	8,000	27,500	2400	29,900				
53	SCTSDL	32	1	1800	150	100	BUR	36,000	17.68	2050	53	8,000	44,000	3280	47,280				
54	TEMPE	1	0	1600	240	80	BUR	34,000	17.68	1920	54		34,000	3072	37,072				
56	PHX	1	0	1200	0	125	AER	19,000	14.49	1325	56		19,000	2120	21,120				
59	PHX	1	0	1900	100	150	AER	31,000	14.49	2150	59		31,000	3440	34,440				
64	TEMPE	1	0	1900	300	200	BUR	42,500	17.68	2400	64	8,000	50,500	3840	54,340				
77	CHNDLR	11	0	2100	500	200	AER	40,500	14.49	2800	77		40,500	4480	44,980				
84	TEMPE	17	0	1100	300	100	BUR	26,500	17.68	1500	84	8,000	34,500	2400	36,900				
90	PHX	1	0	1100	50	75	A	25,000	20.41	1225	90		25,000	1960	26,960				
93	PHX	1	0	1000	120	40	AER	17,000	14.49	1160	93		17,000	1856	18,856				
102	PHX	4	6	2000	900	500	A/C/B	49,000	14.41	3400	102		49,000	5440	54,440				
103	SUN CITY	4	5	1800	1100	500	BUR	56,000	16.47	3400	103	8,000	64,000	5440	69,440				
# SAMPLES =		19				STRUCT TOT =		629,000	MH TOT =		64,000	693,000	62,600	755,600					
						STRUCT AVG=		33,105	AVG=		3,368	36,474	3,295	39,768					
ADJUST FOR COMMON STRUCTURE AND COMMON MANHOLE USE																			
								STRUCTURE COST=				MH COST=							
								AVG * 60% \$19,863				AVG * 25% \$842							
								TOTAL PATH COST AVG =				\$24,000							
														MEDIAN	40,164				
														STD DEV	12,001				
														AVG	39,768				
														SD % OF MEAN	30%				